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POLE GROWER'S GUIDE

Hamlin L. Williston

Southern Forest Experiment Station
Philip A. Briegleb, Director
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CONTENTS

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Pole production in the South is a profitable business involving thousands of landowners and timber operators. During the last ten years an average of over 4,000,000 southern pine poles have been cut annually. This represents approximately 75 percent of the total pole output of the United States (15).1/

Most forest landowners and timber operators are unfamiliar with the problems involved in producing poles. This paper points out some of the factors that should be considered. It also provides a convenient compilation of volume tables, specifications, and references.

TREES THAT WILL MAKE POLES

The consensus of opinion of men experienced both in forest management and pole production is that management practices designed to grow high-quality sawlogs will also grow all the high-quality poles needed. Maintenance of well-stocked, even-aged stands will produce trees suitable for either poles or sawlogs.

Poles are generally marketed under specifications developed by the American Standards Association. These specifications are given in the appendix (p. 15), along with species requirements, a description of the defects permitted, dimensions, manufacturing requirements, and directions as to storage and handling. Poles are classed according to the minimum circumferences acceptable at the top and six feet from the bottom. For example, Class 1 poles 50 feet long must be at least 46 inches in circumference six feet from the butt and 27 inches in cir-

1/ Underscored numbers in parentheses refer to the list of literature on pages 12-14.

cumference at the top. Class 7 poles 50 feet long need to be only 29.5 inches in circumference six feet from the bottom and 15 inches in circumference at the tip.

Pole classes based upon tree circumferences inside the bark are not easily understood by the average landowner. Hawes (9, 14) and Rothacher (11), realizing this, worked up tables giving the minimum tree diameter at breast height, outside bark, required to yield poles of all classes and lengths (tables 1 and 2). Hawes based his table upon the formula:

Table 1.--Minimum diameter at breast height (outside bark) of trees to meet American Standards Association specifications for various classes of southern pine poles

Pole length (feet)	Distance butt to ground line	Pole class	1	2	3	4	5	6	7
		Min. top circumference (inches)	27 inches	25 inches	23 inches	21 inches	19 inches	17 inches	15 inches
		Min. top diameter (inches)	8.6 inches	8.0 inches	7.3 inches	6.7 inches	6.0 inches	5.4 inches	4.8 inches
	Feet					Inches			
16	3.5						7.8	7.1	6.5
18	3.5				9.6	8.9	8.1	7.6	6.9
20	4		11.4	10.7	9.9	9.2	8.5	8.0	7.2
22	4		11.9	11.2	10.5	9.6	8.9	8.3	7.6
25	5		12.5	11.8	10.9	10.1	9.4	8.7	8.0
30	5.5		13.6	12.7	11.8	10.9	10.1	9.4	8.7
35	6		14.5	13.6	12.7	11.6	10.9	9.9	9.2
40	6		15.2	14.3	13.4	12.3	11.4	10.5	9.8
45	6.5		15.9	15.0	13.9	13.0	11.9	11.0	10.3
50	7		16.6	15.6	14.5	13.6	12.5	11.6	10.7
55	7.5		17.2	16.1	15.0	14.1	13.0	12.1	
60	8		17.9	16.6	15.6	14.5	13.4	12.5	
65	8.5		18.4	17.2	16.1	15.0	13.9		
70	9		19.0	17.7	16.6	15.4	14.3		
75	9.5		19.5	18.3	17.0	15.9			
80	10		19.9	18.6	17.5	16.3			
85	10.5		20.4	19.2	17.9				
90	11		20.8	19.5	18.3				

1/ After Hawes (9, 14).

$$\text{DBH (outside bark)} = \frac{\text{Minimum circumference 6 feet from butt}}{0.88 \times 3.1416}$$

Rothacher assumed a taper of 0.1 inch between d. b. h. and the 6-foot point at which the American Standards Association prescribes circumference. Age of timber, degree of taper, and bark thickness all affect pole class and may cause occasional deviations from the values in tables 1 and 2.

Table 2.--Minimum d. b. h. outside bark of southern pine trees to meet specifications for poles of various lengths and classes 1/

Pole length (feet)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
				Inches			
16					8.1	7.4	6.9
18			9.8	9.1	8.4	7.9	7.2
20	11.5	10.8	10.2	9.4	8.8	8.2	7.6
22	12.0	11.3	10.6	9.8	9.1	8.6	7.9
25	12.5	11.8	11.0	10.3	9.6	8.9	8.2
30	13.5	12.7	11.9	11.0	10.3	9.6	8.9
35	14.4	13.6	12.7	11.7	11.0	10.1	9.4
40	15.1	14.3	13.4	12.4	11.5	10.6	10.0
45	15.8	14.9	13.9	13.1	12.0	11.2	10.5
50	16.5	15.5	14.4	13.6	12.5	11.7	10.8
55	17.0	16.0	14.9	14.1	13.1	12.2	
60	17.7	16.5	15.5	14.5	13.4	12.6	

1/ After Rothacher (11). Based on taper of 0.1 inch between d. b. h. (4.5-foot point) and belt line (6-foot point at which American Standards Association prescribes circumference). Average regression computed from data on 119 trees ranging from 6 to 22 inches showed that d. o. b. = 0.57 + 1.081 d. i. b. with a standard error of 0.46 inch.

Hawes (9) developed a pole caliper scale which can be pasted on an ordinary tree caliper. Pole class and length can be read directly from the scale when a prospective pole tree is calipered. This scale, a copy of which will be found following page 34, tends to overestimate pole length in

young stands, but a correction factor can be quickly worked out for individual stands.

MARKETING CONSIDERATIONS

Growing poles can be highly profitable, but anyone interested in doing so should first consider all the questions involved. Is pole production compatible with the objective of management? Is the aim of the timber grower to obtain maximum returns per acre or to supply raw material for a specific type of manufacturing plant? What classes of poles are most profitable to grow? Do poles or sawlogs return the greater stumpage?

Small poles are the bread and butter of the pole industry. There is always a good demand for distribution-line poles, i.e., 35-, 40-, and 45-foot poles. When large transmission poles are needed they are frequently hard to obtain and warrant special consideration because of the stumpage prices they command. The demand for large poles, however, is sporadic, and these sizes make up a comparatively small segment of the business.

Pole Prices and Stumpage Returns

Pole prices vary from one area to another. Table 3 shows the prices paid in 1956 in Arkansas and Louisiana for rough peeled pine poles f. o. b. railway car. The stumpage "royalty" that the landowner receives is generally a percentage of the price the producer obtains for the rough peeled poles loaded on the car. Percentages vary according to the length, demand, supply, cut per acre, and distance from railroad siding. The percentages in effect in Arkansas in 1954 and 1955 are shown in the tabulation on the next page.

Table 3.--Price of rough peeled pine poles in Arkansas and Louisiana, f. o. b. car, 1956

Pole length (feet)	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 9	Class 10
				Dollars				
16				1.15	1.15	1.05	1.00	0.85
18		1.30	1.30	1.30	1.30	1.25	1.20	.95
20	2.00	1.75	1.65	1.65	1.65	1.50	1.45	1.05
25	2.50	2.25	2.25	2.25	2.25	2.00	1.80	1.30
30	4.00	3.25	3.00	3.00	3.00	2.50	2.00	
35	9.00	7.50	7.25	6.50	4.25	3.00		
40	11.00	10.00	9.00	8.00	6.30			
45	13.00	11.50	10.50	8.75				
50	20.00	17.00	14.00					
55	26.00	24.50	19.50					
60	32.00	29.00	26.00					
65	40.00	37.00	31.00					
70	50.00	46.00	40.00					
75	62.50	55.00	48.00					
80	74.00	65.00	50.00					
85	83.00	73.00						
90	92.00	82.00						
95	100.00	90.00						
100	115.00	100.00						

Pole length (feet)	Stumpage received (percent of price f. o. b. car)
16 to 30	25 to 30
35 to 45	40 to 45
50 to 55	50 to 60
55 to 65	60 to 65
70 to 105	60 to 75

Length affects stumpage return to a much greater extent than pole class. It can be seen in table 3 that five feet of additional length will return more in the form of stumpage than a rise of one class. For example, a Class 3 pole 70 feet long is worth $46 on the car and a Class 2 pole of the same length brings $50. But a Class 3 pole 75 feet long returns $55--the increase in length being worth $5 more than a step up in class.

Discretion Needed in Cutting

Timber landowners should insist on selling their poles on a marked woods-run basis. If given a free hand, pole producers will remove many of the best sawlog trees. Those trees most profitably cut into pulpwood are also most suitable for small poles. It is up to the landowner to decide which market best suits his objectives and to mark his timber for cutting accordingly.

Pole users are reluctant to widen the range in size of the poles they require. Most pole buyers, therefore, have a tendency to cut back trees to obtain the lengths and classes for which they have current markets. This refusal to manufacture trees into poles of currently unwanted lengths results in loss of stumpage for the landowner. Where long poles are not in demand, stumpage returns can often be increased by selling the butt log as a high-grade sawlog and the upper portion of the tree as a pole.

Dense stands will produce more lineal feet of poles than sparsely stocked forests, because the taper of trees in dense stands more nearly approximates the class minimum set up in the specifications. Stands in which the production of poles is the primary objective should, therefore, be kept well stocked. The increase in number of long poles produced in heavily stocked stands will more than compensate for slower diameter growth.

Class 1 poles are not always marketable. Furthermore, if oversize Class 1 poles are grown, the stumpage price per thousand board feet is reduced because additional board footage is given for the same price. Prices paid for poles f. o. b. car are often such that the returns per thousand board feet of poles are greater for Class 2 and 3 poles than for Class 1 poles. Class 2 poles, therefore, should be the production maximum of most landowners.

Points of View

The disadvantages mentioned, along with the expense of administering an integrated harvest for two or more products, are frequently enough to outweigh the advantages of producing poles in all but the small sub-sawlog sizes or in lengths 50 feet or longer. One forester, experienced in handling pole stumpage sales, has this to say: "The most profitable market for straight trees 16 to 21 inches d. b. h. is in poles. Trees less than 16 inches d. b. h. or 50 feet in length should not be cut for poles unless of very low grade or too small for logs, since only sawlog stumpage returns can be expected."

In commenting on this statement, a forester engaged in buying poles for a treating plant felt that everything hinged on the stumpage prices paid. He stated that "Currently, 35-, 40-, and 45-foot poles are worth 50 percent of the f. o. b. car price for rough peeled poles if 3 to 5 poles are produced per acre and provided that a rail point is within reasonable distance, i. e., 25 to 40 miles, depending upon the condition of the road. Excellent returns can be realized at this stumpage price from trees of sizes which usually contain a rather high percentage of low-grade lumber. Trees cut in thinning small sawlog-sized stands under these price conditions can very profitably be marked as poles."

Poles Versus Sawlogs

The question will frequently arise as to whether a tree is worth more as sawlogs or as a pole. The sawlog stumpage value of a tree can be determined by multiplying the current stumpage price in dollars per thousand board feet by the volume of the tree in board feet. The board-foot volume of southern pine poles can be read from curves such as those in figure 1, which were developed by Rothacher (11) or from volume tables given on pages 7, 8, and 9.

The pole stumpage value of a tree can be determined by multiplying the f. o. b. price on the car by the current pole "royalty". For

example, a tree which will make a 50-foot Class 2 pole will, according to figure 1, have a volume of 229 board feet. At $40 per MBF for stumpage the sawlog value of such a tree will be $40 x .229 = $9.16. According to table 3, such a pole was worth $20 f.o.b. car in Arkansas. At a pole royalty of 50 percent this tree would be worth $10 on the stump as a pole.

VOLUME TABLES

Some of the differences in opinion as to the merits of integrating pole production with sawlog and pulpwood production are due to the low scale given in some volume tables. This has resulted in underestimating the sawlog volume and value involved. Before using any of the tables in this handbook, pole producers should scale a representative sample of their poles to determine which table, if any, is locally applicable. It may be necessary to develop a local table.

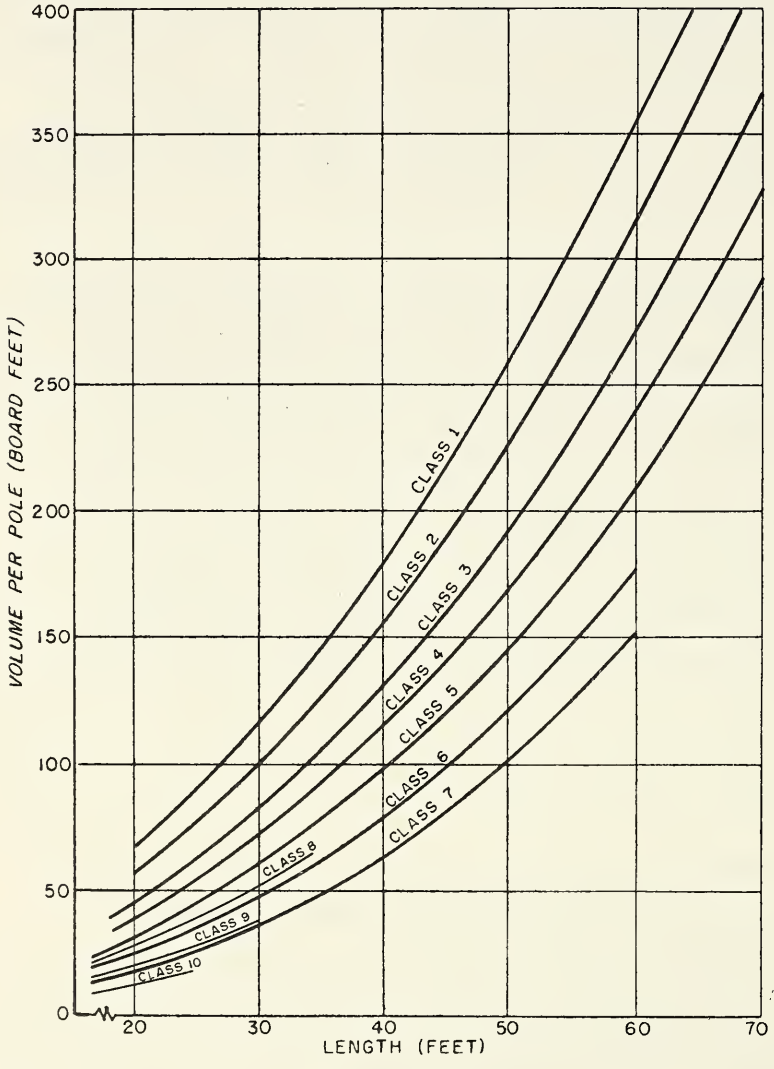


Figure 1.--Volume (International 1/4-inch rule) of southern pine poles of various lengths and classes.

Board-Foot Tables

Tables 4, 5, and 6 show the board-foot contents of pine poles by the International, Doyle, and Scribner rules. These tables, which were compiled by the Southern Region of the U.S. Forest Service (14), are based on the American Standards Association pole specifications for southern pine. An attempt was made, however, to determine the average diameter in each class rather than to use the minimum diameters specified by the American Standards Association.

Table 4. --Contents of poles, International 1/4-inch rule, by class and average top diameter 1/

Pole length (feet)	Class 1 8.9 inches	Class 2 8.3 inches	Class 3 7.6 inches	Class 4 7.0 inches	Class 5 6.4 inches	Class 6 5.7 inches	Class 7 5.1 inches
			Board feet				
16					19	19	12
18			45	33	22	22	14
20	66	50	50	36	31	25	16
22	74	57	57	42	37	29	19
25	87	78	67	49	43	34	21
30	123	97	84	75	55	44	37
35	135	126	117	89	74	57	47
40	184	164	147	115	86	74	62
45	236	191	161	152	117	93	66
50	280	229	203	159	153	113	90
55	320	262	253	202	167	132	
60	384	300	272	228	180	155	
65	417	347	347	283	208		
70	483	405	365	315	238		
75	511	441	428	353			
80	609	517	517	432			
85	629	548	532	456			
90	739	630	630	532			

1/ As published by Southern Region, U. S. Forest Service (14). All poles scaled in 16-foot lengths or less inside bark to the nearest full inch. Average rather than minimum diameters for each class have been used.

Table 5. --Contents 1/ of poles, Doyle rule 2/, by class and average top diameter

Pole length (feet)	Class 1 8.9 inches	Class 2 8.3 inches	Class 3 7.6 inches	Class 4 7.0 inches	Class 5 6.4 inches	Class 6 5.7 inches	Class 7 5.1 inches
			Board feet				
16							
18			24	14	4	4	1
20	38	26	26	15	7	7	3
22	43	37	29	17	12	7	3
25	48	41	32	20	14	9	4
30	71	50	39	33	16	10	4
35	81	75	67	45	19	12	10
40	112	97	82	60	34	22	16
45	150	113	87	81	36	27	21
50	191	158	124	89	55	37	21
55	216	180	158	117	85	53	39
60	267	190	166	130	87	61	
65	276	222	222	169	91	72	
70	347	286	231	195	105		
75	361	313	287	222	132		
80	445	360	360	285			
85	461	384	371	292			
90	556	455	455	365			

1/ As published by Southern Region, U. S. Forest Service (14). All poles scaled in 16-foot lengths or less inside bark to the nearest full inch. Average rather than minimum diameters for each class have been used.

2/ $V = \frac{(D-4)^2 L}{16}$

These tables will not always check on individual poles, but should give a reasonably accurate answer for a group of poles. In compiling the tables both the Doyle and International scales were applied to the diameter inside bark and the values read to the nearest full inch. Each pole was scaled in lengths of no more than 16 feet. In some localities scaling practices may vary from those described. For example, it is very common in some places to scale logs smaller than 8 inches in diameter by giving them a value equal to their length. This was not done in these tables.

Table 6. --Contents 1/ of poles, Scribner rule 2/, by class and average top diameter

Pole length (feet)	Class 1 8.9 inches	Class 2 8.3 inches	Class 3 7.6 inches	Class 4 7.0 inches	Class 5 6.4 inches	Class 6 5.7 inches	Class 7 5.1 inches
			Board feet 3/				
16					20	20	20
18			40	30	20	20	20
20	60	50	50	30	30	20	20
22	60	50	50	30	30	30	20
25	70	50	50	40	30	30	20
30	100	80	60	60	40	40	40
35	110	100	90	60	60	50	40
40	160	130	120	100	90	60	50
45	200	160	130	130	100	80	60
50	230	190	160	140	110	90	70
55	260	220	200	160	130	110	
60	320	240	220	190	140	130	
65	350	280	280	240	180		
70	410	350	290	260	200		
75	440	400	370	290			
80	530	440	440	380			
85	550	470	460	400			
90	650	550	550	450			

1/ As published by Southern Region, U. S. Forest Service (14). All poles scaled in 16-foot lengths or less inside bark to nearest full inch. Average rather than minimum diameter for each class used.

2/ $V = 0.79D^2 - (2D + 4)$.

3/ Rounded to nearest 10 feet.

Table 7.--Volume of poles in board feet (Doyle rule) for slash and longleaf pine in southern Alabama 1/

Pole length (feet)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
				-Board feet-			
30				37	25	20	
35	123	97	77	57	42	33	23
40	146	115	96	77	59	46	36
45	181	139	115	97	81	62	
50		179	148	126			

1/ From unpublished data by T. C. Croker, Southern Forest Experiment Station.

Table 8.--Volume of poles in board feet (International 1/4-inch rule) for slash and longleaf pine in southern Alabama 1/

Pole length (feet)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
				-Board feet-			
30				80	65	56	
35	184	151	129	106	88	76	60
40	221	184	160	139	116	99	85
45	269	224	193	172	153	129	
50		264	231	207			

1/ From unpublished data by T. C. Croker, Southern Forest Experiment Station.

Table 9.--Volume of poles in board feet (Doyle rule) for shortleaf and loblolly pine in southern Arkansas 1/

Pole length (feet)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
				-Board feet-			
35	105	95	73	57	47	42	20
40	136	121	106	85	67	55	
45	182	149	128	109	93		
50	214	177	147	130			
55	253	216	172	148			
60	303	248	205	182			
65	342	297	247	216			
70	408	344	296	244			
75	466	390	339	278			
80	522	447	385				
85	578	510	425				
90	660	566	467				
95	760	638	520				
100	865	726	585				
105	975	820	660				

1/ From unpublished data by R. F. Kennedy, The Crossett Company.

Croker measured and classified 3,844 slash and longleaf pine poles near Brewton, Alabama. Tables 7 and 8 were prepared from these measurements. He found that volumes computed from the Southern Region tables were 26 percent lower in board feet Doyle, 18 percent lower in Scribner, and 19 percent lower in International than his local tables. R. F. Kennedy compiled a Doyle-rule volume table (table 9) from measurements taken of 569 shortleaf and loblolly poles in southern Arkansas; his values averaged 23 percent higher than the Southern Region tables. Instances such as these emphasize the need for a careful check of volume tables if it is suspected that local pole utilization or tapers differ from those of the tables under consideration.

Pole volumes by the International rule were also computed (table 10) by Rothacher (11). He assumed a taper of 1/2 inch in 4 feet and employed the International 1/4-inch rule formula for 4-foot sections ($.22D^2 - .71D$). Neither Rothacher's nor the Southern Region's assumptions appear to be consistent with actual pole measurements. More board feet are usually involved in a given pole than the pole volume tables indicate, probably because poles taper more rapidly to a larger butt than to a minimum-sized butt.

Table 10. --Volumes of southern pine poles, International 1/4-inch rule, by class and average top diameter 1/

Pole length (feet)	Class 1 8.9 inches	Class 2 8.3 inches	Class 3 7.6 inches	Class 4 7.0 inches	Class 5 6.4 inches	Class 6 5.7 inches	Class 7 5.1 inches	Class 8 6.1 inches	Class 9 5.2 inches	Class 10 4.3 inches
					Board feet					
16					22	17	12	20	13	8
18			40	33	27	20	15	24	16	10
20	66	57	46	38	31	24	18	28	19	12
22	75	65	53	44	36	28	21	32	22	14
25	90	78	64	54	44	34	26	40	28	18
30	116	101	85	72	59	47	37	54	39	
35	146	128	108	92	77	62	50	70		
40	180	158	134	115	97	79	64			
45	217	192	164	142	120	99	82			
50	258	229	197	172	147	122	102			
55	304	271	234	205	177	149	126			
60	353	316	275	242	210	178	152			
65	408	366	320	283	248					
70	467	421	370	329	289					
75	530	480	424	378						
80	599	543	482	432						
85	674	613	546							
90	754	687	614							

1/ After Rothacher (11). Taper established at 1/2-inch in 4 feet and the International 1/4-inch log rule formula for 4-foot sections used.

Cubic-Foot Tables

Pulpwood producers will be interested in the cubic volumes involved in poles of different sizes. Table 11 was constructed from Rothacher's d.b.h.-top d.i.b. table and Grosenbaugh's Giant Tree Table (8). Cubic-foot volumes compiled in this manner vary some-

Table 11. --Cubic volumes of southern pine poles, by class and average top diameter 1/

Pole length (feet)	Class 1 8.9 inches	Class 2 8.3 inches	Class 3 7.6 inches	Class 4 7.0 inches	Class 5 6.4 inches	Class 6 5.7 inches	Class 7 5.1 inches	Class 8 6.1 inches	Class 9 5.2 inches	Class 10 4.3 inches
					Cubic feet					
16					4.8	4.0	3.3	4.5	3.4	2.4
18			7.6	6.6	5.6	4.7	3.9	5.2	4.0	2.8
20	11.3	9.9	8.6	7.5	6.4	5.4	4.5	6.0	4.6	3.3
22	12.7	11.2	9.8	8.5	7.3	6.2	5.2	6.8	5.3	3.8
25	15.0	13.3	11.6	10.1	8.7	7.4	6.2	8.2	6.4	4.7
30	19.1	17.0	15.0	13.1	11.3	9.7	8.2	10.7	8.5	
35	23.7	21.1	18.7	16.5	14.3	12.3	10.5	13.5		
40	28.7	25.7	22.8	20.2	17.7	15.3	13.1			
45	34.2	30.7	27.4	24.3	21.4	18.7	16.1			
50	40.2	36.2	32.4	28.9	25.5	22.4	19.5			
55	46.7	42.2	37.9	33.9	30.1	26.5	23.2			
60	53.7	48.7	43.9	39.4	35.1	31.1	27.3			
65	61.3	55.7	50.4	45.4	40.6					
70	69.5	63.3	57.4	51.9	46.6					
75	78.3	71.5	65.0	58.9						
80	87.7	80.3	73.2	66.5						
85	97.7	89.7	82.0							
90	108.4	99.7	91.4							

1/ Basis: Grosenbaugh's Giant Tree Table (8) and Rothacher's d. b. h. -top d. i. b. table (11).

what from those in table 12, which shows the cubic-foot volume and weight of poles treated with 8 pounds of creosote as given in the Handbook of Treated Forest Products (1). Table 12 was based on the American Standards Association cubic table. A cubic-foot volume table prepared by Croker (table 13 p. 12) checked within 5 percent of the cubic-foot table of the American Standards Association.

Table 12. --Cubic volume and treated weights per pole of southern pine poles 1/

Pole length (feet)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10
					CUBIC VOLUME					
					Cubic feet					
16					4.25	3.67	3.00	3.42	2.50	2.00
18			6.92	5.92	5.00	4.25	3.42	3.83	2.75	2.42
20	12.91	10.25	8.50	7.17	6.00	5.17	4.25	4.75	3.67	2.92
22	15.00	12.25	10.17	8.42	7.25	6.17	5.17	5.58	4.25	3.42
25	18.00	14.75	12.25	10.42	8.92	7.67	6.25	7.08	5.25	4.25
30	23.25	19.67	16.75	14.25	12.00	10.00	8.25	9.38	6.75	
35	28.50	24.42	21.00	18.25	15.67	13.50	11.75	12.67		
40	34.25	29.50	25.50	22.17	19.25	16.75	14.67			
45	40.41	34.75	30.25	26.25	23.17	20.25	17.75			
50	47.00	40.25	35.00	30.67	27.17	24.17	21.25			
55	54.42	46.67	40.00	35.17	31.25	28.42				
60	62.75	53.50	45.67	39.75	35.50	32.75				
65	73.00	60.75	51.17	44.67	40.67					
70	84.00	68.75	57.17	49.67	45.25					
75	94.50	77.00	63.75	54.92						
80	106.67	86.17	70.67	60.25						
85	120.00	95.75	78.17							
90	135.67	106.75	86.00							
					TREATED WEIGHTS					
					Pounds					
16					234	202	165	188	138	110
18			380	326	275	234	188	211	151	133
20	710	564	467	394	330	284	234	261	202	160
22	825	674	559	463	398	339	284	307	234	188
25	990	811	674	573	490	422	344	389	289	235
30	1,280	1,082	921	784	660	550	454	513	371	
35	1,567	1,343	1,155	1,004	862	742	646	697		
40	1,884	1,622	1,403	1,219	1,059	921	807			
45	2,222	1,911	1,664	1,444	1,274	1,114	976			
50	2,585	2,214	1,925	1,687	1,494	1,329	1,169			
55	2,993	2,567	2,200	1,934	1,718	1,563				
60	3,765	3,210	2,740	2,385	2,130	1,965				
65	4,380	3,645	3,070	2,680	2,440					
70	5,040	4,125	3,430	2,980	2,715					
75	5,670	4,620	3,825	3,295						
80	6,400	5,170	4,240	3,615						
85	7,200	5,745	4,690							
90	8,140	6,405	5,160							

1/ From the Handbook of Treated Forest Products (1). The weights in this table are based on treatment with a final retention of 8 pounds of Grade 1 creosote oil. For other retentions add to or subtract from the basic weights one pound per cubic foot for each one-pound variation in the retention of preservative specified.

Table 13.--Cubic volume of slash and longleaf pine poles in southern Alabama 1/

Pole length (feet)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7
	- - - - - - - Cubic feet - - - - - - -						
30				14.4	12.1	10.9	
35	28.5	24.5	21.4	18.3	15.8	14.1	
40	33.9	29.3	26.0	23.3	20.3	17.9	11.9
45	41.2	34.9	31.2	28.3	25.8	22.6	16.0
50		41.1	36.7	33.5			

1/ From unpublished data by T. C. Croker, Southern Forest Experiment Station.

LITERATURE AVAILABLE

Very little has been written on the management of pine stands for the production of poles. A partial bibliography of the literature about poles is included here for the reader's convenience. It deals mainly with specifications, preservative treatment, resource estimates, and the golden opportunities awaiting pole producers.

Piling production is largely a special-order business about which almost nothing has been written. Piling specifications are included in the appendix for the benefit of those who may be interested in piling as well as poles.

(1) American Creosote Works.
[n. d.] Handbook of treated forest products. Amer. Creosote Works, Inc., New Orleans, La.

(2) American Forestry Association.
1946. Report on supply and production of wood poles in the United States of America. American Forestry Association Forest Resource Appraisal. A project of the American Forestry Association sponsored by the Edison Electric Institute and the Association of Edison Illuminating Companies. 36 pp., illus.

(3) Anderson, I. V.
1948. Trends in the utilization of pole species and their effect on forest management. Soc. Amer. Foresters Meeting 1947: 128-140, illus.

(4) Bond, W. E.
1947. More dollars from integrated utilization. South. Lumberman 175(2201): 220-222, illus.

(5) Clapp, R. T.
1947. Farmers might produce more poles. Miss. Agr. Expt. Sta. Cir. 130, 8 pp.

(6) Croker, T. C., Jr.
1951. Checked your pole volume tables lately? U. S. Forest Serv. South. Forest Expt. Sta. South. Forestry Notes 75.

(7) Graeber, R. W., and Barker, W. J.
1939. Comparative value of pine trees for lumber or poles. N. C. Agr. Ext. Serv., 7 pp.

(8) Grosenbaugh, L. R.
1954. New tree-measurement concepts: height accumulation, giant tree, taper and shape. U. S. Forest Serv. South. Forest Expt. Sta. Occas. Paper 134, 32 pp.

(9) Hawes, E. T.
1947. A method of determining southern pine pole classes from d. b. h. Jour. Forestry 45: 204-205, illus.

(10) Ostrander, M. D.
1953. Production and marketing of wood piling and poles in the Northeast. U. S. Forest Serv. Northeast. Forest Expt. Sta. Sta. Paper 57, 23 pp., illus.

(11) Rothacher, J. S.
1947. A basis for comparing the value of southern yellow pines for lumber and poles. TVA Forestry Relations Dept. Tech. Note 7, 5 pp., illus.

(12) Southeastern Forest Experiment Station.
1949. Markets for forest products in southwest Georgia. U.S. Forest Serv. Southeast. Forest Expt. Sta. Sta. Paper 1, 77 pp., illus.

(13) Southern Forest Experiment Station.
1937. Pole and pile timber in the pine-hardwood region--west. U. S. Forest Serv. South. Forest Expt. Sta. Forest Survey Release 28, 11 pp., illus.

(14) Southern Region, U. S. Forest Service.
1951. Volume tables, converting factors, and other information applicable to commercial timber in the South. Ed. 6, 49 pp. Div. State and Private Forestry, South. Region, U. S. Forest Serv. Atlanta, Ga.

(15) U. S. Forest Service.
Wood preservation statistics. (Issued annually by the Forest Service, U. S. Department of Agriculture, in cooperation with the American Wood-preservers' Association.)

(16) Vaughan, J. A.
1952. Problems in supply and manufacture of southern pine poles. Jour. Forestry 50: 362-364.

APPENDIX A. AMERICAN STANDARD SPECIFICATIONS AND DIMENSIONS FOR WOOD POLES

The following excerpts are reproduced, by permission, from Publication 05.1-1948 of the American Standards Association, "American Standard Specifications and Dimensions for Wood Poles." Complete copies of the specifications are available from the American Standards Association, Inc., 70 East 45 Street, New York 17, N. Y.

1. Scope and General

1.1 Scope. This standard consists of specifications and dimensions for wood poles that are to be given a preservative treatment.

1.2 General. The species, the length and class of poles, the type of treatment (including seasoning details, if seasoning is desired), and complete details for the roofing, gaining, boring, and branding shall be given in the purchase orders.

Complete detailed instructions shall be given the supplier whenever the requirements of these specifications are modified to meet special conditions.

1.3 Definitions. For definitions of terms used in these specifications see Section 6.

Specifications

2. Material Requirements

2.1 Species.

Group I: Fiber stress 3600 pounds per square inch
- Northern white (eastern) cedar (*Thuja occidentalis*)

Group II: Fiber stress 5600 pounds per square inch
- Western red cedar (*Thuja plicata*)

Group III: Fiber stress 6000 pounds per square inch
- Ponderosa pine (*Pinus ponderosa*)

Group IV: Fiber stress 6600 pounds per square inch
- Western firs (true firs)
  - California red fir (*Abies magnifica*)
  - Grand fir (*Abies grandis*)
  - Noble fir (*Abies nobilis*)
  - Pacific silver fir (*Abies amabilis*)
  - White fir (*Abies concolor*)
- Lodgepole pine (*Pinus contorta*)
- Northern pines
  - Jack pine (*Pinus banksiana*)
  - Red (Norway) pine (*Pinus resinosa*)

Group V: Fiber stress 7400 pounds per square inch
- Douglas fir—all types (*Pseudotsuga taxifolia*)
- Western hemlock (*Tsuga heterophylla*)
- Southern pines
  - Longleaf pine (*Pinus palustris*)
  - Shortleaf pine (*Pinus echinata*)
  - Loblolly pine (*Pinus taeda*)
  - Slash pine (*Pinus caribaea*)
  - Pond pine (*Pinus rigida serotina*)

Group VI: Fiber stress 8400 pounds per square inch
- Western larch (western tamarack) (*Larix occidentalis*)

2.2 Prohibited Defects.

Cross-breaks (cracks)
Bird holes
Plugged holes, except increment borer holes
Hollow butts or tops, except as permitted under "Hollow Pith Centers" and "Defective Butts"
Marine borer damage
Splits or through-checks in the top
Decay, except as permitted under "Firm Red Heart," "Dead Knots," and "Defective Butts"
Nails, spikes, and other metal not specifically authorized by the purchaser

2.3 Permitted Defects

2.3.1 ***Sap Stain.*** Sap stain that is not accompanied by softening or other disintegration (decay) of the wood is permitted.

2.3.2 ***Firm Red Heart.*** Firm red heart not accompanied by softening or other disintegration (decay) of the wood is permitted.

2.3.3 ***Spiral Grain.*** Spiral grain (twist grain) is permitted as follows:

Length of Pole	Maximum Twist of Grain Permitted
30 feet and shorter	1 complete twist in any 10 feet
35 feet to 45 feet, inclusive	1 complete twist in any 16 feet
50 feet and longer	1 complete twist in any 20 feet

2.3.4 ***Hollow Pith Centers.*** Hollow pith centers in the tops or butts and in knots are permitted in poles that are to be given full-length treatment.

2.4 Limited Defects

2.4.1 ***Checks and Splits in Butts.*** Through-checks or splits in the butt surface are permitted, provided that their height from the butt along the side surface does not exceed 2 feet.

2.4.2 ***Shakes.*** Shakes in the butt surface extending through an arc of not more than 90 degrees are permitted. Shakes extending through an arc of more than 90 degrees are permitted when they are inside of a circle the center of which corresponds to the center of the butt surface and the diameter of which is not greater than one-half the average butt diameter.

Shakes in the top surface are permitted in poles that are to be given full-length treatment provided that the width of the shake does not exceed $\frac{1}{16}$ inch and provided that the diameter of the shake is not greater than one-half the diameter of the top of the pole.

2.4.3 ***Insect Damage.*** Insect damage consisting of holes $\frac{1}{16}$ inch or less in diameter, or surface scoring or channeling are permitted. All other forms of insect damage are prohibited, except that associated with hollow heart in cedar poles.

2.4.4 ***Knots.*** The diameter of any single knot or the sum of the diameters of all knots in any 1-foot section shall not exceed the limits set up in the following table. Knots $\frac{1}{2}$ inch or less in diameter shall be ignored in applying the limitations for the sum of diameters.

Limitations of Knot Size

Length of Pole (Feet)	Maximum Sizes Permitted		
	Diameter of Any Single Knot (Inches)		Sum of Diameters of All Knots in Any One-Foot Section (Inches)
	Classes		
	1 to 3	4 to 10	
45 and shorter	4	3	8
50 and longer	5	5	10

2.4.4.1 *Dead Knots.* Decay is permitted in knots provided it is not associated with heart rot.

2.4.5 ***Scars.*** No pole shall have a scar or turpentine face (southern pine) located within 2 feet of the ground line. Turpentine scars need be trimmed only to the extent necessary to examine for evidence of fungus infection and insect damage. Other sound scars are permitted elsewhere on the pole surface, provided they are smoothly trimmed and do not interfere with the cutting of any gain, and provided:

(*a*) That the circumference at any point on trimmed surfaces located between the butt and 2 feet below the ground line is not less than the minimum circumference specified at 6 feet from the butt for the class and length of the pole; and

(*b*) That the depth of the trimmed scar is not more than 2 inches, if the diameter is 10 inches or less, or one-fifth of the pole diameter at the location of the scar if such diameter is more than 10 inches.

2.4.6 ***Dead Streaks.*** Sound dead streaks, not wider than one-fourth of the circumference of the pole at the point of measurement, are permitted.

2.4.7 ***Compression Wood.*** The outer 1 inch of all poles shall be free from compression wood.

2.4.8 ***Defective Butts.*** Hollowing in the butt caused by "splinter pulling" in felling the tree is permitted, provided that the area of such a hollow is less than 10 percent of the butt area. Hollow heart is permitted in cedar poles only, provided that the area of the hollow does not exceed 10 percent of the butt area, and that the depth of the hollow does not exceed 2 feet measured from the butt surface.

Decay is permitted in the butt of cedar poles only, provided that the aggregate area of decay and hollow heart does not exceed 10 percent of the entire butt surface.

2.4.9 ***Shape.*** Poles shall be free from short crooks.

A pole may have sweep subject to the following limitations:

(*a*) Where sweep is in one plane and one direction only, a straight line joining the surface of the pole at the ground line and the edge of the pole at the top shall not be distant from the surface of the pole at any point by more than 1 inch for each 6 feet of length between these points, except in northern white cedar poles.* (See Diagram 1 of sub-

* For northern white cedar poles the straight line between the edge of the top and the ground line shall not be distant from the surface of the pole at any point by more than 1 inch for each 4 feet of length between those points.

sidiary drawing entitled "Measurement of Sweep and Short Crook in Poles.")

(*b*) Where sweep is in two planes (double sweep), except in northern white cedar poles,* or in two directions in one plane (reverse sweep), a straight line connecting the mid-point at the ground line with the mid-point at the top shall not at any intermediate point pass through the surface of the pole. (See Diagram 2 of subsidiary drawing entitled "Measurement of Sweep and Short Crook in Poles.")

3. Dimensions

3.1 Length. Poles less than 50 feet in length shall be not more than 3 inches shorter or 6 inches longer than nominal length. Poles 50 feet or more in length shall be not more than 6 inches shorter or 12 inches longer than nominal length.

Length shall be measured between the extreme ends of the pole.

3.2 Circumference. The minimum circumferences at 6 feet from the butt (except for Classes 8, 9, and 10) and at the top, for each length and class of pole, are listed in the tables of dimensions. The circumference at 6 feet from the butt of poles in Classes 1 to 7, inclusive, shall be not more than 7 inches larger than the specified minimum.

The top dimensional requirement shall apply at a point corresponding to the minimum length permitted for the pole.

3.3 Classification. The true circumference class shall be determined as follows:

Measure the circumference at 6 feet from the butt. This dimension will determine the true class of the pole, provided that its top (measured at the minimum length point) is large enough. Otherwise the circumference at the top will determine the true class, provided that the circumference at 6 feet from the butt does not exceed the specified minimum by more than 7 inches.

4. Manufacturing Requirements

4.1 Bark Removal. Outer bark shall be completely removed from all poles.

On all poles no patch of inner bark more than 1 inch wide shall be left on the pole surface between the butt and 2 feet below the ground line.

On poles that are to be full-length treated, no patch of inner bark larger than 1 inch wide and 6 inches long shall be left on the pole surface between the top and 2 feet below the ground line.

On poles that are to be butt treated, no patch of inner bark larger than 1 inch wide and 6 inches long shall be left on the pole surface between points 1 foot above and 2 feet below the ground line.

4.2 Sawing. All poles shall be neatly sawed at the top (unless otherwise ordered) and at the butt along a plane which shall not be out of square with the axis of the pole by more than 2 inches per foot of diameter of the sawed surface. Beveling at the edge of the sawed butt surface not more than one-twelfth of the butt diameter in width, or an equivalent area unsymmetrically located, is permitted.

4.3 Trimming. Completely overgrown knots rising more than 1 inch above the pole surface, branch stubs, and partially overgrown knots shall be trimmed close. Completely overgrown knots less than 1 inch high need not be trimmed. Trimming may be done by shaving machine or by hand.

4.4 Framing. All poles that are to be given a full-length preservative treatment shall be roofed, gained, and bored in accordance with the terms of the purchase order before treatment.

All gains (mortise or slab type) shall be cut on the face of the pole; and the gained surfaces shall be in approximately parallel planes.

4.5 Marking. The following marks shall be stamped or branded legibly on the face and the butt of each pole (see note below):

(*a*) The supplier's code or trade-mark;

(*b*) The plant location and the year of treatment;

(*c*) Code letters denoting the pole species and preservative used;

(*d*) The true circumference class numeral and numerals showing the length of the pole. The letter "C" shall circumscribe the true class numeral on the butt.

NOTE: The supplier's code or trade-mark, the plant location and year of treatment [(*a*) and (*b*) above] may be omitted from the butt by agreement of supplier and purchaser.

The code letters, not less than 5/8 inch high,

* The double sweep limitation for northern white cedar poles shall be as follows:
"Where sweep is in two planes (double sweep), the sum of the sweeps in the two planes (each sweep being measured as shown on Diagram 1 of the subsidiary drawing) shall be not greater than the allowance for sweep in one plane and one direction for a pole of the same length."

designating the pole species and preservative used shall be as follows:

Species	Species and Preservative (Creosote) Code Letters
Northern white (eastern) cedar	ECC
Western red cedar	WCC
Western firs	WFC
California red fir	
Grand fir	
Noble fir	
Pacific silver fir	
White fir	
Douglas fir	DFC
Western hemlock	WHC
Western larch (Western tamarack)	WLC
Lodgepole pine	LPC
Northern pines	NPC
Jack pine	
Red pine	
Southern pines	SPC
Longleaf pine	
Shortleaf pine	
Loblolly pine	
Slash pine	
Pond pine	
Western pine	WPC
Ponderosa pine	

The appropriate preservative code letter shall be chosen from the following list:

C = Creosote
T = Creosote-coal-tar solutions
X = Creosote-petroleum solutions
N = Copper naphthenate solutions
P = Pentachlorophenol solutions
S = Salt solutions (any type)

Code letters designating preservatives other than those listed, or modifications of the letters listed with a view to designating specific types rather than broad classes of solutions, may be used on agreement between supplier and purchaser.

On the face of the pole the brand or mark shall be placed squarely and so located that the bottom of the brand or mark will be at a point designated by the purchaser.

If the supplier's name, plant location, and year of treatment are included, the arrangement and order of the code letters and figures shall be as follows:

	INTERPRETATION
PCC	Supplier's code or trade-mark Pole Creosoting Company
C-48	Plant location and year of treatment City Year, as 1948
SPC	Species and preservative code Southern pine, Creosote
5-35	Size Class 5 — 35-foot pole

On the butt of the pole the brand or mark may be the same as that placed on the face of the pole, in which case the class numeral need not be circumscribed with a C; or the code letters for species and preservative may be stamped into the butt with a die or hammer.

5. Storage and Handling

5.1 Storage. When it is necessary to hold poles in storage, they shall be stacked on treated skids of such dimensions and so arranged as to support the poles without producing noticeable distortion of any of them. The height of the piles shall be limited so as to avoid damage to poles on the bottom layers.

Poles shall be piled and supported in such a manner that all poles are at least 1 foot above the general ground level and any vegetation growing thereon. No decayed or decaying wood shall be permitted to remain underneath stored poles.

5.2 Handling. Treated poles shall not be dragged along the ground. Cant hooks, pole tongs, or other tools shall not be applied to the ground line section of any pole.

6. Definition of Terms

The following definitions shall apply in these specifications.

6.1 Check. A check is a separation of the wood along the grain, the greater part of which occurs across the rings of annual growth.

A through check extends from surface to surface of the pole, usually through the pith center.

6.2 Compression Wood. Compression wood is abnormal wood that often forms on the lower side of branches and inclined trunks of coniferous trees. Compression wood is:

(*a*) Characterized by relatively wide annual rings, usually eccentric;

(*b*) Has a relatively high proportion of summerwood (frequently more than 50 percent of the width of the annual rings in which it occurs);

(*c*) Exhibits but little contrast in color between springwood and summerwood; and

(*d*) Shrinks excessively lengthwise as compared with normal wood.

6.3 Cross-break (Crack). A cross-break is a separation of the wood cells across the grain. Such breaks may be due to internal strains resulting from unequal longitudinal shrinkage or to external forces.

6.4 Dead Knot. A dead knot is a knot left by a branch that dies before the tree is cut. An encased knot is a dead knot in which the growth layers are not intergrown with those of the surrounding wood. Dead knots may contain soft fibers (decay) that usually do not extend deeper than an inch or two from the pole surface. They are distinct from rotten or decayed knots in which the loose or soft fibers (decay) may extend the full length of the knot into the pole, and which are frequently associated with heart rot.

6.5 Dead Streak. A dead streak is any portion of the sapwood in which the life processes had ended prior to the cutting of the tree. A dead streak starts from the butt and differs from a wound, such as a cat face or scar, where the growth of new wood shows that life processes are still acting to repair the injured part.

6.6 Decay. Decay is the disintegration of wood substance due to the action of wood-destroying fungi. Rot and dote mean the same as decay.

6.7 Face of Pole. The face of a pole is the concave side, or the side of greatest curvature in poles having reverse or double sweep, between the ground line and top.

6.8 Ground Line Section. The ground line section is that portion of a pole between 1 foot above and 2 feet below the ground line as defined in the pole dimension tables.

6.9 Hollow Heart. A hollow heart is a hollow in the heartwood of a living tree caused by insects or fungi.

6.10 Hollow Pith Center. A hollow pith center is a small hole at the pith center of the trunk or of a knot, caused by disintegration of the pith (small soft core occurring in the structural center of a tree or branch).

6.11 Insect Damage. Insect damage is the result of boring in the pole by insects or insect larvae. Scoring or channeling of the pole surface is not classed as insect damage.

6.12 Knot Diameter. A knot diameter is the diameter of a knot on the surface of the pole measured in a direction at right angles to the lengthwise axis of the pole.

6.13 Red Heart. Red heart is caused by a fungus, *Fomes pini*, that occurs in the living tree. It is characterized in the early stages of infection by a reddish or brownish color in the heartwood. This is known as "firm red heart." Later the wood in the case of the living tree, disintegrates (decays) in small, usually distinct, areas that develop into white-line pockets.

6.14 Sap Stain. Sap stain is a discoloration of the sapwood caused by the action of certain molds and fungi that is not accompanied by softening or other disintegration of the wood.

6.15 Scar (Cat Face). A scar is a depression in the surface of the pole resulting from a wound where healing has not re-established the normal cross section of the pole.

6.16 Shake. A shake is a separation along the grain, the greater part of which occurs between the rings of annual growth.

6.17 Short Crook. A short crook is a localized deviation from straightness which, within any section 5 feet or less in length, is more than one-half the mean diameter of the crooked section. (See Diagram 3 of the subsidiary drawing entitled "Measurement of Sweep and Short Crook in Poles.")

6.18 Spiral Grain (Twist Grain). Spiral grain is a type of growth in which the fibers take a spiral course about the bole of a tree instead of the normal vertical course. The spiral may extend right-handed or left-handed around the tree trunk. The amount of spiral grain in a pole is measured as the

distance in feet, along the axis of the pole, in which one complete twist of the spiral occurs, and is expressed as, for example, 1 in 10.

6.19 Split. A split is a lengthwise separation of the wood due to the tearing apart of the wood cells, extending from surface to surface of the pole.

6.20 Sweep. Sweep is the deviation of a pole from straightness. (See Diagrams 1 and 2 of the subsidiary drawing entitled "Measurement of Sweep and Short Crook in Poles.")

Dimensions

TABLE 5. Dimensions of Douglas Fir (All Types), Western Hemlock, and Southern Pine Poles
(Fiber Stress 7400 pounds per square inch)

Class		1	2	3	4	5	6	7	8	9	10
Minimum Circumference at Top (Inches)		27	25	23	21	19	17	15	18	15	12
Length of Pole (Feet)	*Ground Line Dist from Butt (Feet)	Minimum Circumference at 6 Feet from Butt (Inches)									
16	3½					21.5	19.5	18.0			
18	3½			26.5	24.5	22.5	21.0	19.0			
20	4	31.5	29.5	27.5	25.5	23.5	22.0	20.0			
22	4	33.0	31.0	29.0	26.5	24.5	23.0	21.0			No Butt Requirements†
25	5	34.5	32.5	30.0	28.0	26.0	24.0	22.0		No Butt Requirements†	
30	5½	37.5	35.0	32.5	30.0	28.0	26.0	24.0	No Butt Requirements†		
35	6	40.0	37.5	35.0	32.0	30.0	27.5	25.5			
40	6	42.0	39.5	37.0	34.0	31.5	29.0	27.0			
45	6½	44.0	41.5	38.5	36.0	33.0	30.5	28.5			
50	7	46.0	43.0	40.0	37.5	34.5	32.0	29.5			
55	7½	47.5	44.5	41.5	39.0	36.0	33.5				
60	8	49.5	46.0	43.0	40.0	37.0	34.5				
65	8½	51.0	47.5	44.5	41.5	38.5					
70	9	52.5	49.0	46.0	42.5	39.5					
75	9½	54.0	50.5	47.0	44.0						
80	10	55.0	51.5	48.5	45.0						
85	10½	56.5	53.0	49.5							
90	11	57.5	54.0	50.5							
95	11	58.5	55.0	51.5							
100	11	60.0	56.0	52.5							

*The figures in this column are intended solely for use whenever a definition of ground line is necessary in order to apply specification requirements relating to scars, straightness, etc.

†Lines indicate length limits.

MEASUREMENT OF SWEEP AND SHORT CROOK IN POLES

DIAGRAM 1—Measurement of Sweep in One Plane and One Direction

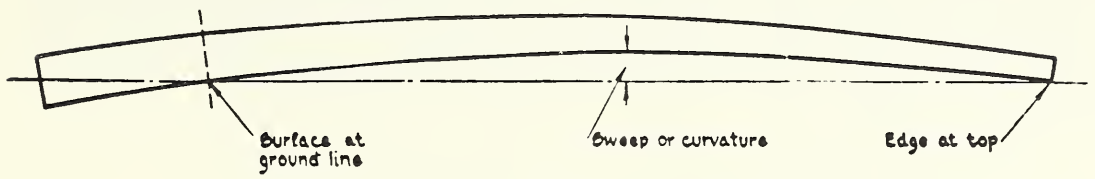


DIAGRAM 2—Measurement of Sweep in Two Planes (Double Sweep) or in Two Directions in One Plane (Reverse Sweep)

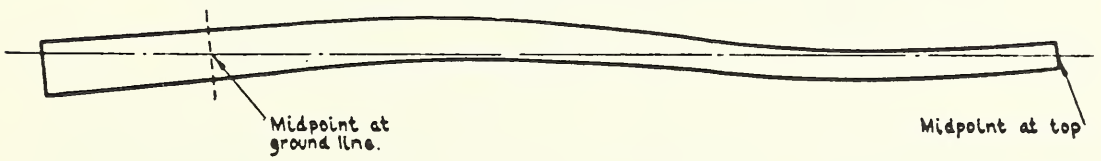
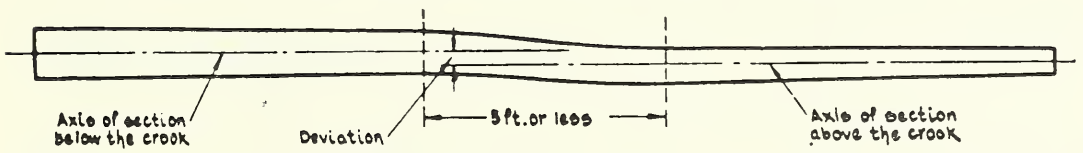
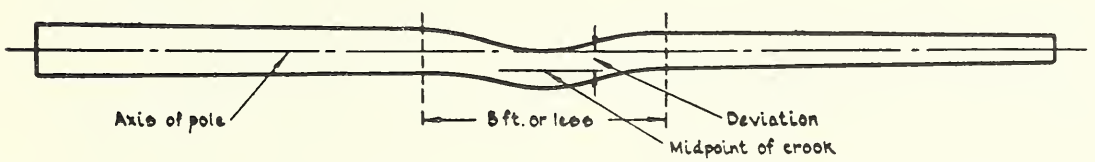


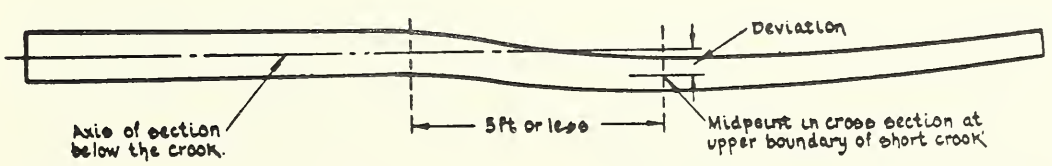
DIAGRAM 3—Measurement of Short Crook (Three Cases Shown)



Case 1: where the reference axes are approximately parallel.



Case 2: where axes of sections above and below the crook coincide or are practically coincident.



Case 3: where axis of section above short crook is not parallel or coincident with axis below the crook.

NOTE: The three cases shown under Diagram 3 are typical and are intended to establish the principle of measuring short crooks. There may be other cases not exactly like those illustrated.

APPENDIX B. STANDARD SPECIFICATIONS FOR ROUND TIMBER PILES

The following specifications are reproduced by permission of the American Society for Testing Materials. Separate copies are available from the headquarters of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

ASTM Designation: D 25 – 55

ADOPTED, 1955 [2]

This Standard of the American Society for Testing Materials is issued under the fixed designation D 25; the final number indicates the year of original adoption as standard or, in the case of revision, the year of last revision.

Scope

1. These specifications cover round timber piles to be used untreated or treated with standard preservatives. Contracts which do not specify if piles are to be treated or untreated, shall be construed as requiring piles for treatment (Note 1).

NOTE 1.—The purpose of these specifications is to provide satisfactory piles for driving to bearing values that are related to the supporting power of the soil, rather than to the ultimate strength of the pile. Where round timber piles are used in structural design to sustain loads or forces approaching the maximum safe working strength of structural lumber, they should be designed in accordance with the principles of the Tentative Methods for Establishing Structural Grades of Lumber (ASTM Designation: D 245).[3] Sawed lumber used as piles may be selected in accordance with the same principles where the use requires a specific strength value.

[1] Under the standardization procedure of the Society, these specifications are under the jurisdiction of the ASTM Committee D-7 on Wood.

[2] Prior to their present adoption as standard, these specifications were published as tentative from 1915 to 1920. They were adopted in 1920, published as standard from 1920 to 1930, but withdrawn and republished as tentative from 1930 to 1937, being revised in 1934 and 1935. They were again adopted in 1937, and published as standard from 1937 to 1952. They were revised and reverted to tentative in 1952 and were published as tentative from 1952 to 1955, being revised in 1953 and 1954.

[3] See p. 997.

Species of Wood

2. Piles may be of any species of wood which will withstand driving and will support the loads imposed. The purchaser shall specify the species of wood desired (Note 2).

NOTE 2.—Commonly used species include cedars, cypress, Douglas-fir, elm, hemlock, western larch, maple, oaks, pines, spruces, and tamarack.

Use Classification

3. Timber piles are classified in these specifications under three general divisions according to the use intended, as follows:

(*a*) *Class A.*—Piles suitable for use in heavy railway bridges or other heavy framed construction. The minimum diameter of butt permits the use of load-bearing timber caps 14 in. in width.

(*b*) *Class B.*—Piles suitable for use in docks, wharves, bridges, building or other foundations, and general construction. The minimum diameter of butt permits the use of load-bearing timber caps 12 in. in width (Note 3).

NOTE 3.—Smaller sizes than those stipulated for Class B piles in Section 6 and Table I may

be specified by the purchaser, where piles of Class B quality are desired for use with light bearing values or in special cases, as with concrete caps.

(*c*) *Class C.*—Piles suitable for use in foundations which will always be completely submerged, for cofferdams, falsework, or light construction.

knot, provided that the unsoundness extends to not more than a 1½-in. depth, and that the adjacent areas of the trunk are not affected. Piles having sound turpentine scars undamaged by insects may be accepted.

(*b*) Piles shall be cut above the ground swell, and shall have a continuous

TABLE I.—CIRCUMFERENCES AND DIAMETERS OF TIMBER PILES.

Length, ft	Class A						Class B						Class C					
	3 Ft from Butt				At Tip, min		3 Ft from Butt				At Tip, min		3 Ft from Butt				At Tip, min	
	Min		Max				Min		Max				Min		Max			
	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.	Circumference, in.	Diameter (approx), in.
DOUGLAS-FIR, HEMLOCK, LARCH, PINE, SPRUCE, OR TAMARACK																		
Under 40	44	14	57	18	28	9	38	12	63	20	25	8	38[a]	12[a]	63	20	25	8
40 to 50 incl	44	14	57	18	28	9	38	12	63	20	22	7	38	12	63	20	19	6
51 to 70 incl	44	14	57	18	25	8	41	13	63	20	22	7	38	12	63	20	19	6
71 to 90 incl	44	14	63	20	22	7	41	13	63	20	19	6	38	12	63	20	19	6
Over 90	44	14	63	20	19	6	41	13	63	20	16	5	38	12	63	20	16	5
OAK AND OTHER HARDWOODS, CYPRESS																		
Under 30	44	14	57	18	28	9	38	12	57	18	25	8	38[a]	12[a]	63	20	25	8
30 to 40 incl	44	14	57	18	28	9	41	13	63	20	22	7	38	12	63	20	22	7
Over 40	44	14	57	18	25	8	41	13	63	20	19	6	38	12	63	20	19	6
CEDAR																		
Under 30	44	14	69	22	28	9	38	12	69	22	25	8	38[a]	12[a]	69	22	25	8
30 to 40 incl	44	14	69	22	28	9	41	13	69	22	25	8	38	12	69	22	25	8
Over 40	44	14	69	22	25	8	41	13	69	22	22	7	38	12	69	22	22	7

[a] In Class C piles, a minimum circumference of 31 in. or diameter of 10 in. at cut-off may be specified for lengths of 20 ft and under.

REQUIREMENTS FOR ALL CLASSES OF PILES

General Quality

4. (*a*) Piles shall be of sound wood, free from decay, red heart, or insect attack, except as herein provided. The butt end of cedar and cypress piles may have a pipe or stump rot hole not more than 1½ in. in diameter. Cypress piles may have peck aggregating not more than the hole limitation. Southern pine piles may have unsound knots not exceeding half the permitted size of a sound

taper from the point of butt measurement to the tip.

(*c*) Sizes of knots shall be as specified in Section 13 or 18. Knot clusters are prohibited (Note 4).

NOTE 4.—A knot cluster is two or more knots grouped together, the fibers of the wood being deflected around the entire unit. A group of single knots, with fibers deflected around each knot separately, is not a cluster, even though the knots may be in close proximity.

Lengths

5. All piles shall be furnished cut to any of the following lengths as specified:

16 to 40 ft in multiples of 2 ft; over 40 ft, in multiples of 5 ft. Individual piles may vary from the length specified as much as ±1 ft in piles shorter than 40 ft, and ±2 ft in piles 40 ft or longer. The average length of all piles of a specified length in each shipment shall be not less than the length specified.

Circumferences and Diameters

6. (*a*) The circumferences of piles measured under the bark shall have minimum and maximum values as given in Table I, except that not more than 10 per cent of the piles in any shipment may have circumferences 2 in. less than the tabulated minimum values.

(*b*) The ratio of the maximum to the minimum diameter at the butt of any pile shall not exceed 1.2.

Heartwood

7. If high heartwood content is required in untreated piles, it shall be specified, and the diameter of the heartwood shall be not less than eight tenths of the diameter of the pile at the butt.

Sapwood

8. Wood piles for preservative treatment shall have not less than 1 in. of sapwood at the butt end.

Cutting and Trimming

9. (*a*) Butts and tips of piles shall be sawed square with the axis of the pile.

(*b*) All knots and limbs shall be trimmed or smoothly cut flush with the surface of the pile, except that knots may be hand-trimmed flush with the surface of the swell surrounding the knot.

Peeling

10. (*a*) Piles are classified according to the extent of bark removal as clean-peeled, rough-peeled, or unpeeled.

(*b*) Clean-peeled piles require the removal of all outer bark. In addition, at least 80 per cent of the inner bark, well distributed over the surface of the pile, shall be removed. For proper preservative treatment, no strips of inner bark wider than ½ in. shall remain.

(*c*) Rough-peeled piles require the complete removal of all outer bark.

(*d*) Unpeeled piles require no bark removal.

REQUIREMENTS FOR CLASS A OR B PILES

Straightness

11. (*a*) A straight line from the center of the butt to the center of the tip of Class A or B piles shall lie entirely within the body of the pile (Note 5).

NOTE 5.—Long piles for driving to lighter bearing values may be bought under a more liberal alternative specification as follows: "A straight line from the center of the butt to the center of the tip may lie partly outside the body of the pile, but the maximum distance between the line and the pile shall not exceed one-half per cent of the length of the pile or 3 in., whichever is smaller."

(*b*) Class A or B piles shall be free from short crooks in which the deviation from straightness in any 5 ft of length anywhere exceeds 2½ in. (Fig. 1). Short crooks shall also comply with the requirements for sweep in Paragraph (*a*).

Twist of Grain

12. Twist of spiral grain in any 20 ft of length shall not exceed one half of the circumference at the midpoint of length measured.

Knots

13. Sound knots in Class A or B piles 50 ft or less in length, and in three-quarters of the length from the butt of Class A or B piles longer than 50 ft, shall be no larger than 4 in. or one-third of the diameter of the pile at the point where they occur, whichever is the smaller. Sound knots in the remaining one-

quarter of the length of piles longer than 50 ft shall be no larger than 5 in. or one-half of the diameter of the pile at the point where they occur, whichever is the smaller. The size of a knot shall be its diameter measured at right angles to the length of the pile. Unsound knots shall not be permitted, except as specified under Section 4(*a*). Cluster knots are prohibited (Note 4). The sum of sizes of all knots in any foot of length of the pile shall not exceed twice the size of the largest permitted single knot.

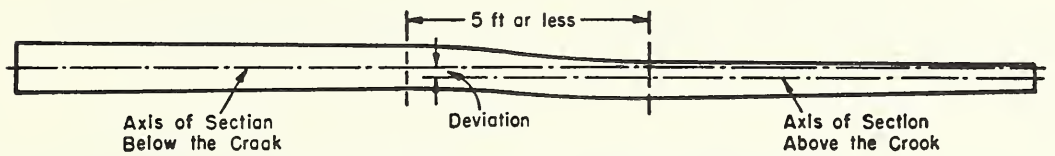
Holes

14. Holes less than ½ in. in average diameter shall be permitted in Class A or B piles, provided the sum of the average diameters of all holes in any square foot of pile surface does not exceed 1½ in.

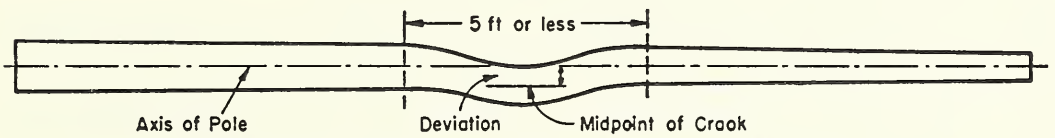
Splits and Shakes

15. (*a*) Splits in Class A or B piles shall be not longer than the butt diameter.

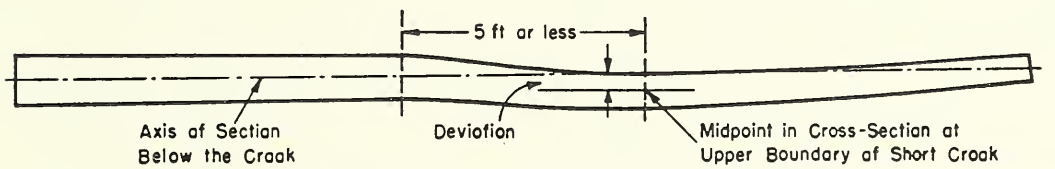
(*b*) The length of any shake or combination of shakes in the outer half of the radius of the butt of the pile, when measured along the curve of the annual ring, shall not exceed one third of the circumference of the butt of the pile.



Case 1 - Where the Reference Axes are Approximately Parallel



Case 2 - Where Axes of Sections Above and Below the Crook Coincide or are Practically Coincident



Case 3 - Where Axis of Section Above Short Crook is not Parallel or Coincident with Axis Below the Crook

The three cases shown are typical, and are intended to establish the principle of measuring short crooks. There may be other cases not exactly like those illustrated.

FIG. 1.—Measurement of Short Crook.

REQUIREMENTS FOR CLASS C PILES

Straightness

16. (*a*) A straight line from the center of the butt to the center of the tip of Class C piles may lie partly outside the body of the pile, but the maximum distance between the line and the pile shall not exceed ½ per cent of the length of the pile, or 3 in., whichever is the smaller.

(*b*) Class C piles shall be free from short crooks in which the deviation from straightness in any 5 ft of length anywhere exceeds $2\frac{1}{2}$ in. (Fig. 1). Short crooks shall also comply with the requirements for sweep in Paragraph (*a*).

Twist of Grain

17. Twist of spiral grain in any 20 ft of length shall not exceed the circumference at the midpoint of length measured.

Knots

18. Sound knots in Class C piles shall be no larger than 5 in., or one half the diameter of the pile at the point where they occur, whichever is the smaller. The size of a knot shall be its diameter measured at right angles to the length of the pile. Unsound knots shall not be permitted, except as specified under Section 4(*a*). Cluster knots are prohibited (Note 4). The sum of sizes of all knots in any foot of length of the pile shall not exceed twice the size of the largest permitted single knot.

Holes

19. Holes less than $\frac{1}{2}$ in. in average diameter shall be permitted in Class C piles, provided the sum of the average diameters of all holes in any square foot of pile surface does not exceed 3 in.

Splits and Shakes

20. (*a*) Splits in Class C piles shall be not longer than one and one half times the butt diameter.

(*b*) The length of any shake or combination of shakes in the outer half of the radius of the butt of the pile, when measured along the curve of the annual ring, shall not exceed one half of the circumference of the butt of the pile.

APPENDIX C.
FEDERAL SPECIFICATIONS FOR WOODEN PILES

These specifications were issued on February 13, 1957, as item MM-P-371a (superseding MM-P-371, March 31, 1947). Separate copies are available at 10 cents apiece from the General Services Administration R-3, 7th and G Streets, SW, Washington, D. C. For bidding purposes copies are available free, as noted in the second column of the specifications, below.

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope.—This specification covers round timber piles to be used untreated or treated with standard preservatives.

1.2 Classification.

1.2.1 *Types.*—Wood piles shall be of the following types, as specified.

Type I.—Untreated

Type II.—Treated

1.2.2 *Classes.*—Wood piles shall be of the following classes, as specified.

Class A.—Heavy construction

Class B.—General construction

Class C.—Light construction.

2. APPLICABLE SPECIFICATIONS, STANDARDS, AND OTHER PUBLICATIONS

2.1 Specifications and standards.—The following specifications and standards, of the issues in effect on date of invitation for bids, form a part of this specification:

Federal Specifications:

TT–W–571—Wood Preservative, Recommended Treating Practice.

(Activities outside the Federal Government may obtain copies of Federal Specifications and Standards as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, Seattle, and Washington, D. C.

(Federal Government activities may obtain copies of Federal Specifications and Standards and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL–STD–129 — Marking for Shipment and Storage.

(Copies of Military Specifications and Standards required by the contractor in connection with specific procurement functions, should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. — The following documents form a part of this specification. Unless otherwise indicated, the issues in effect on date of invitation for bids shall apply.

FSC Class 5510

American Wood Preservers' Association Publications:

Manual of Recommended Practice:

C–1 Standards for Preservative Treatment by Pressure Processes—All Timber Products.

C–3 Standard for the Preservative Treatment of Piles by Pressure Processes.

P–1 Standard for Creosote.

(Copies of American Wood Preservers' Association Publications may be obtained from the Secretary-Treasurer, 839 17th Street, NW., Washington 6, D. C.)

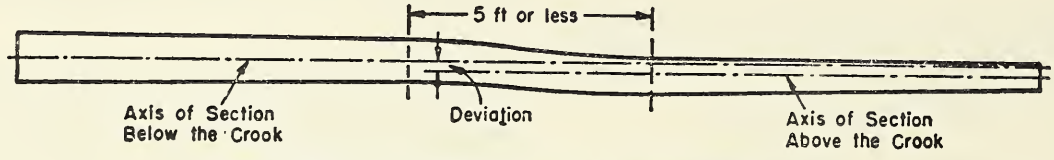
3. REQUIREMENTS

3.1 Material.—Piles shall be of the kinds of wood specified. (See 6.4.)

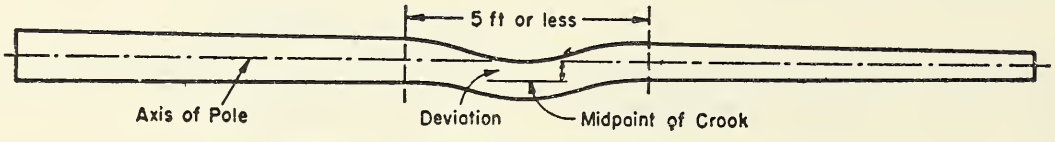
3.2 Workmanship. — Piles shall be cut above the ground swell. Butts and tips shall be sawed square with the axis of the pile. All knots and limbs shall be trimmed or smoothly cut flush with the surface of the pile, except that knots may be hand-trimmed flush with the surface of the swell surrounding the knot.

3.2.1 *Peeling.*—Type I untreated piles shall be either rough peeled or clean peeled, unless unpeeled, rough peeled, or clean peeled is specified (see 6.8.4). Type II treated piles shall be clean peeled.

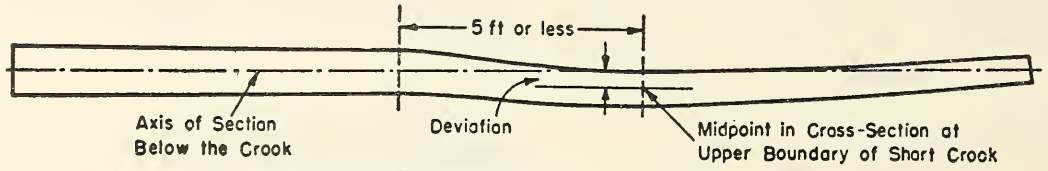
3.3 General Quality.—Piles shall be sound, free of decay, red heart, or insect attack except: (a) the butt end of cedar and cypress piles may have a pipe or stump rot hole not more than 1½ inches in diameter; (b) cypress piles may have peck aggregating not more than the hole limitation; (c) Southern pine piles may have unsound knots no larger than half the permitted size of sound knots, provided that the unsoundness is no deeper than 1½ inches and that adjacent areas of the pile are not affected. Piles having sound turpentine scars undamaged by insects may be accepted.



Case 1–Where the Reference Axes are Approximately Parallel



Case 2–Where Axes of Sections Above and Below the Crook Coincide or are Practically Coincident



Case 3–Where Axis of Section Above Short Crook is not Parallel or Coincident with Axis Below the Crook

The three cases shown are typical, and are intended to establish the principle of measuring short crooks. There may be other cases not exactly like those illustrated

FIGURE 1.—Measurement of short crook.

TABLE I.—*Circumferences and diameters of timber piles*

Length, feet	Class A						Class B						Class C					
	3 ft. from butt				At tip, min.		3 ft. from butt				At tip, min.		3 ft. from butt				At tip, min.	
	Min.		*Max.*				*Min.*		*Max.*				*Min.*		*Max.*			
	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.	Circumference, in.	Diameter (Approx), in.
DOUGLAS-FIR, HEMLOCK, LARCH, PINE, SPRUCE, OR TAMARACK																		
Under 40	44	14	57	18	28	9	38	12	63	20	25	8	38[a]	12[a]	63	20	25	8
40 to 50 incl.	44	14	57	18	28	9	38	12	63	20	22	7	38	12	63	20	19	6
55 to 70 incl.	44	14	57	18	25	8	41	13	63	20	22	7	38	12	63	20	19	6
75 to 90 incl.	44	14	63	20	22	7	41	13	63	20	19	6	38	12	63	20	19	6
Over 90	44	14	63	20	19	6	41	13	63	20	16	5	38	12	63	20	16	5
OAK AND OTHER HARDWOODS, CYPRESS																		
Under 30	44	14	57	18	28	9	38	12	57	18	25	8	38[a]	12[a]	63	20	25	8
30 to 40 incl.	44	14	57	18	28	9	41	13	63	20	22	7	38	12	63	20	22	7
Over 40	44	14	57	18	25	8	41	13	63	20	19	6	38	12	63	20	19	6
CEDAR																		
Under 30	44	14	69	22	28	9	38	12	69	22	25	8	38[a]	12[a]	69	22	25	8
30 to 40 incl.	44	14	69	22	28	9	41	13	69	22	25	8	38	12	69	22	25	8
Over 40	44	14	69	22	25	8	41	13	69	22	22	7	38	12	69	22	22	7

[a]In class C piles, a minimum circumference of 31 inches or diameter of 10 inches at 3 ft. from butt may be specified for lengths of 20 ft. and under.

3.4 **Lengths.**—Wood piles shall be supplied in the lengths specified, as follows:

16 to 40 feet, in multiples of 2 feet.
Over 40 feet, in multiples of 5 feet.

3.4.1 *Tolerance in length.*—Individual piles may vary from the length specified as much as ± 1 foot in piles shorter than 40 feet, and ± 2 feet in piles 40 feet and longer. The average length of all piles of a specified length in each shipment shall be not less than the length specified.

3.5 **Circumferences and diameters.** — The circumferences of piles measured under the bark shall have minimum and maximum values as given in table I, except that not more than 10 percent of the piles in any shipment may have circumferences 2 inches less than the tabulated minimum values. The longer diameter at the butt of any pile shall be not more than 1.2 times the shorter diameter.

3.6 **Heartwood.**—If high heartwood content is required in type I untreated piles it shall be specified, and the diameter of the heartwood shall be not less than eight-tenths the diameter of the pile at the butt. (See 6.5.)

3.7 **Sapwood.**—Type II treated piles shall have not less than 1 inch of sapwood at the butt end.

3.8 **Class A or B piles.**

3.8.1 *Straightness.*—A straight line from the center of the butt to the center of the tip of class A or class B piles shall lie entirely within the body of the pile[1]. Class A or class B piles shall be free of short crooks in which the deviation from straightness in any 5 feet of length anywhere exceeds 2½ inches (see fig. 1). Piles having short crooks shall also comply with the general requirements for straightness.

3.8.2 *Twist of grain.*—Twist of spiral grain in any 20 feet of length shall not exceed one-half of the circumference at the midpoint of the length measured.

3.8.3 *Knots.*—Sound knots in class A or class B piles 50 feet or less in length, and in three-quarters of the length from the butt in longer piles, shall be no larger than 4 inches or one-third of the diameter of the pile at the point where they occur, whichever is smaller. Sound knots in the remaining one-quarter of the length of piles longer than 50 feet shall be no larger than 5 inches or one-half of the diameter of the pile at the point where they occur, whichever is smaller. The size of a knot shall be its diameter measured at right angles to the length of the pile. Unsound knots shall not be permitted except as stipulated in 3.3. Knot cluster shall not be permitted. The sum of the sizes of all knots in any foot of length of the pile shall not exceed twice the size of the largest single knot permitted.

3.8.4 *Holes.*—Holes less than ½ inch in average diameter shall be permitted in class A or class B piles, provided the sum of the average diameters of all holes in any square foot of pile surface does not exceed 1½ inches.

3.8.5 *Splits and shakes.*—Splits in class A or class B piles shall be no longer than the butt diameter. The length of any shake or combination of shakes in the outer half of the radius of the butt of the pile, when measured along the curve of the annual ring, shall not exceed one-third the circumference of the butt of the pile.

[1] Long piles for driving to lighter bearing values may be bought under a more liberal alternative specification as follows: "A straight line from the center of the butt to the center of the tip may lie partly outside the body of the pile, but the maximum distance between the line and the pile shall not exceed one-half percent of the length of the pile or 3 inches, whichever is smaller."

3.9 Class C piles.

3.9.1 *Straightness.*—A straight line from the center of the butt to the center of the tip of class C piles may lie partly outside the body of the pile, but the maximum distance between the line and pile shall not exceed ½ percent of the length of the pile, or 3 inches, whichever is smaller. Class C piles shall be free of short crooks in which the deviation from straightness in any 5 feet of length anywhere exceeds 2½ inches (see fig. 1). Piles having short crooks shall also comply with the general requirement for straightness.

3.9.2 *Twist of grain.*—Twist of spiral grain in any 20 feet of length shall not exceed the circumference at the midpoint of the length measured.

3.9.3 *Knots.*—Sound knots in class C piles shall be no larger than 5 inches, or one-half the diameter of the pile at the point where they occur, whichever is smaller. The size of a knot shall be its diameter measured at right angles to the length of the pile. Unsound knots shall not be permitted except as stipulated in 3.3. Knot clusters shall not be permitted. The sum of the sizes of all knots in any foot of length of the pile shall not exceed twice the size of the largest single knot permitted.

3.9.4 *Holes.*—Holes less than ½ inch in average diameter shall be permitted in class C piles, provided the sum of the average diameters of all holes in any square foot of pile surface does not exceed 3 inches.

3.9.5 *Splits and shakes.*—Splits in class C piles shall be no longer than one and one-half times the butt diameter. The length of any shake or combination of shakes in the outer half of the radius of the butt of the pile, when measured along the curve of the annual ring, shall not exceed one-half of the circumference of the butt of the pile.

3.10 Treatment.—Unless otherwise specified, treatment shall conform to the requirements of Federal Specification TT–W–571. The type of treatment and the minimum retention per cubic foot shall be as specified.

3.10.1 *Military (Navy).* — When treated piles (type II) are specified, the preservative treatment, in lieu of the requirements of 3.10, shall conform to the following: Piles shall be given a preservative treatment of coal-tar creosote oil by the pressure process. The retention of oil per cubic foot of wood shall be not less than 20 pounds for yellow pine and 14 pounds for Douglas fir. Creosote oil and methods of treatment shall meet the requirements of the following applicable specifications which form a part of the American Wood Preservers Association Manual of Recommended Practice: C–1 Standards for Preservative Treatment by Pressure Processes—All Timber Products, C–3 Standard for the Preservation Treatment of Piles by Pressure Processes, and P–1 Standard for Creosote.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Place of inspection.

4.1.1 Type I piles shall be inspected where specified.

4.1.2 Type II piles shall be inspected at the treating plant.

4.2 **Inspection.**—Inspectors shall make a thorough inspection of each pile for conformance to this specification. Treated piles shall be inspected for conformance to the treatment specified.

4.3 **Measurements.** — Suitable measuring instruments shall be used to determine lengths and sizes of piles as well as the sizes of knots and other characteristics covered by this specification.

5. PREPARATION FOR DELIVERY

5.1 Shipment.—Unless otherwise specified, piles shall be shipped in accordance with standard commercial practice. Loading for shipment shall be in accordance with the applicable carrier regulations.

5.2 Marking. — Marking, segregation of species, lengths, and classes shall be as specified.

5.2.1 Special marking or preparation for shipment required by public carriers shall be performed by the contractor without expense to the Government. Marking for military piles shall be marked in accordance with Military Standard MIL–STD–129.

6. NOTES

6.1 Intended use. — The purpose of this specification is to define satisfactory piles for driving to bearing values that are related to the supporting power of the soil, rather than the ultimate strength of the pile. Where round timber piles are used in structural design to sustain loads or forces approaching the safe working strength of structural lumber they should be designed as structural members and so specified; for this the following standard is recommended: "Tentative Methods for Establishing Structural Grades of Lumber" (ASTM Designation: D245). The piles defined in this specification are identical with those described in "Standard Specifications for Round Timber Piles" (ASTM Designation: D25–55).

6.2 Ordering data. — Purchases should specify type, class, species and length of piles required and should exercise any desired options offered herein. (See 1.2, 1.3, 3.1, 3.2.1, 3.3, 3.4, 3.6, 3.7, 3.10, 4.1.1, 5.1, 5.2, 6.3, 6.4, 6.6.)

6.3 Use classification.—Class A piles are large, high-quality piles suitable for heavy railway bridges and trestles, piers and other heavy construction. The minimum diameter of butt permits the use of load-bearing timber caps 14 inches wide. Class B piles may be smaller but are of the same high quality as class A. They are suitable for docks, wharves, highway work, building foundations, and general construction. The minimum diameter of butt permits the use of load-bearing timber caps 12 inches wide. If special purpose piles of class B quality but smaller than standard size are desired they must be specially specified. In general, class C piles may be smaller than either of the other classes. Their quality may be lower but they are suitable for submerged foundations, building foundations where loads are not excessive, cofferdams, falsework, and sundry temporary work.

6.4 Kinds of wood.—Douglas fir, Southern pine, and oak are the principal kinds of wood used for piles. The cedars, chestnut, cypress, larch, red pine, lodgepole pine, ponderosa pine, the spruces, and tamarack are sometimes used and are generally available. Invitations for bids need not be restricted to one kind of wood.

6.4.1 Although not ordinarily considered as pile woods, sweet birch, yellow birch, sugar maple, American elm, rock elm, sweet gum, swamp tupelo, and water tupelo have many characteristics that make them suitable for pile use. When available, the inclusion of these woods in invitation for bids may be advisable.

6.5 Heartwood.—The service life of untreated piles used under conditions where decay is a factor may be increased by using piles having a large proportion of heartwood. However, some kinds of wood in trees of pile size do not have much heartwood. Therefore a heartwood stipulation in the invitation for bids for untreated piles is appropriate only when actually required and when high heartwood content timber is available. Heartwood is of no significance in piles that will remain continuously wet.

6.6 Treatment[1].—Piles used for permanent construction under conditions of exposure to attack by fungi, insects, or borers should be treated.

6.7 Handling. — Piles, particularly long piles, should be handled carefully to avoid breakage, mechanical damage, or injuries. Treated piling should be carefully handled to prevent mechanical damage or penetration of the treated sapwood which could allow entrance of fungi, insects or marine borers to the untreated heartwood and greatly decrease service life.

6.8 Definitions.

6.8.1 *Split.*—Lengthwise separation of the wood, most of which occurs across the rings of annual growth, extending through the pile.

6.8.2 *Shake.*—Separation along the grain, most of which occurs between the rings of annual growth.

6.8.3 *Knot cluster.*—Two or more knots grouped together, the fibers of the wood being deflected around the entire unit. A group of single knots, with the fibers deflected around each knot separately is not a cluster, even though the knots may be in close proximity.

6.8.4 *Peeling.*—There are two kinds of peeled piles.

6.8.4.1 Clean peeled piles require the removal of all outer bark. In addition, at least 80 percent of the inner bark, well distributed over the surface of the pile shall be removed. For proper preservative treatment, no strips of inner bark wider than ½ inch shall remain. The sapwood shall not be cut through or removed in the process of peeling.

6.8.4.2 Rough peeled piles require the removal of all outer bark. The removal of inner bark is immaterial.

6.9 It is believed that this specification adequately describes the characteristics necessary to secure the desired materials, and that normally no samples will be necessary prior to award to determine compliance with the specification. If, for any particular purpose, samples with bids are necessary, they should be specifically asked for in the invitation for bids, and the particular purpose to be served by the bid sample shall be definitely stated, the specification to apply in all other respects.

6.10 Federal specifications do not include all types, classes, grades, sizes, etc., of the commodities indicated by the titles of the specifications, or which are commercially available, but are intended to cover the types, classes, etc., which are suitable for Federal Government requirements.

[1] No species is immune to attack by marine borers without treatment. The sapwood of no species is immune to decay without treatment. The heartwood of some species, such as cedar and cypress, is naturally decay resistant without treatment (see 6.5). Such species are suitable for shore use without treatment if the service life is expected to be short. For the most part, it is advisable to use treated piling regardless of species or end use. The treatment always provides added protection. Since penetration in round timbers, such as poles and piling, is chiefly confined to the sapwood, it is necessary to consider the relative ease with which the sapwood can be penetrated when piling is to be treated. In the case of the species listed in 6.4, the sapwood of the spruces can be classed as definitely resistant to treatment. Both the sapwood and heartwood of the several spruce species are resistant and there is little difference in their relative penetrability. Cedar sapwood is also more or less resistant, especially in the region where the sapwood changes to heartwood, but the sapwood of this species is much less resistant than the sapwood of the spruces. The sapwood of Douglas fir and larch is usually somewhat more resistant than that of the pines but the difference is not great. With the exception of the spruces and cedars, the sapwood of the other species listed can be considered moderately easy to treat by the pressure process.

6.11 Transportation description. — Transportation description applicable to this item is:

Piling, wooden, whether or not creosoted or otherwise preservatively treated.
Carload minimum weight 36,000 pounds.

Piling, wooden.
Truckload minimum weight 36,000 pounds.

Patent notice.—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

MILITARY INTERESTS:
Army—E
Navy—Y Sh S
Air Force.

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